A Framework for MCWL Experiments

Welcome to MCWL

- **Assignment: Project X**
  - **Contract management? LTA / LOE / AWE?**
  - **Hypothesis? Experiment Design?**
  - **Analyses? Data collection?**

PME goals

1. Provide an intellectual framework for planning and executing military experiments

2. Share lessons learned

The PME is not…

- **An END STATE that provides everything Lab personnel should know about experimentation**
- **A recipe for success**
- **A proposed SOP**

Outline

- **Introduction to military experiments**
- **Planning and executing MCWL experiments…some steps and tips**
- **Key takeaways**

What is a military experiment?

MCWL Approved Definition

American Heritage Dictionary

A test under controlled conditions that is conducted to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untried.

Challenges to military experimentation

- The human variable*
- Simulation of real combat conditions during experiments*
- Extraordinarily long development cycles and shifting priorities
- Innovations developed as: surrogates, prototypes, models
- Time and resources

Why experiment?

- **To serve as cradle and test bed for developing enhanced operational concepts, TTPs, and doctrine**
- **To help integrate new technologies**
- **To help refine warfighting requirements**
- **To facilitate operational reform**
- **To facilitate development, field testing, and implementation of future operational and functional concepts, and potential solutions**

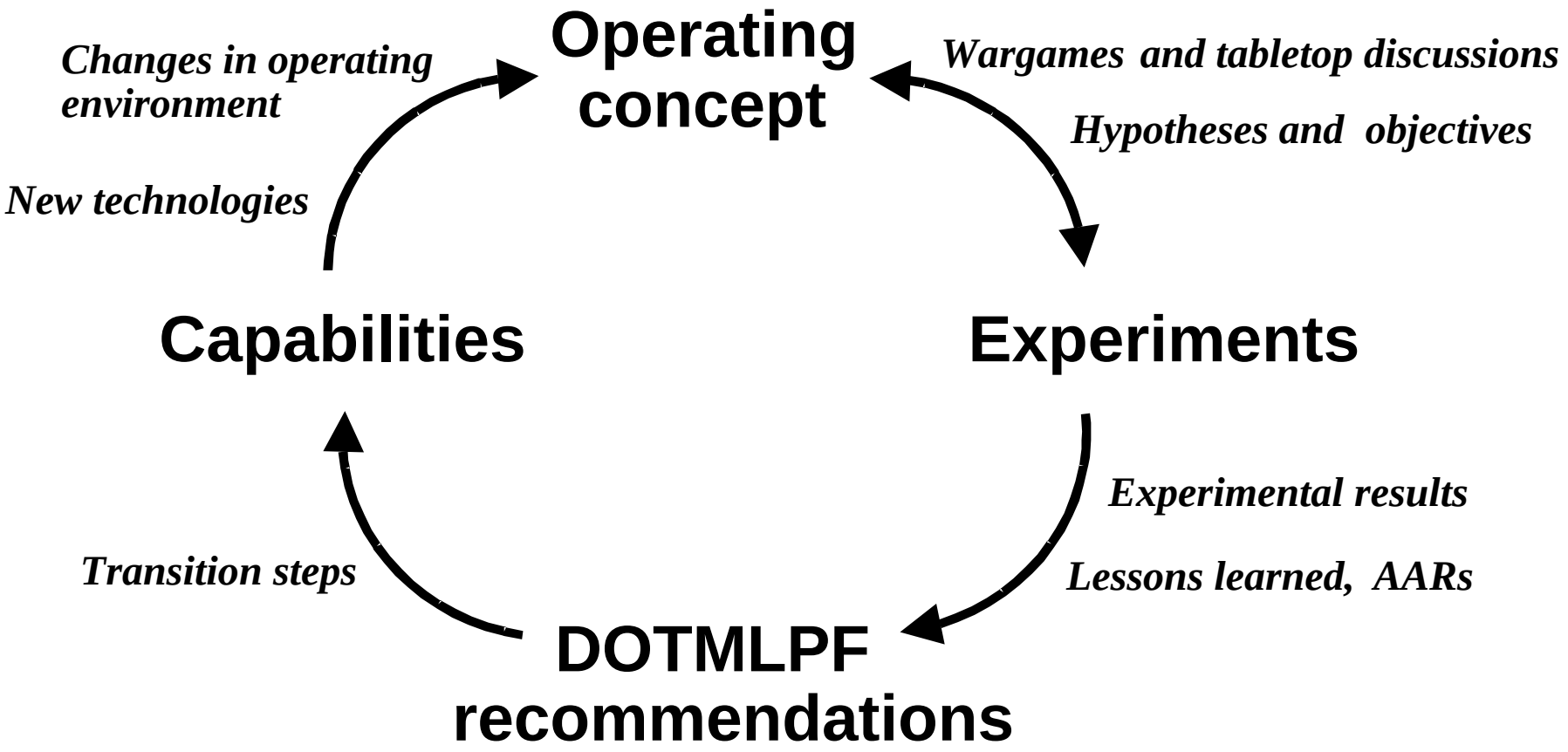
To tell us something we need to know to push USMC into the future

Keys to a successful experiment

- Good conceptual basis for the experiment
- Considers an innovation (i.e., doing something differently than the way it is currently done)
- Generates questions and answers
- Something is produced (e.g., results are written down somewhere)

Concept-based experimentation

From concept to capability… where experiments fit

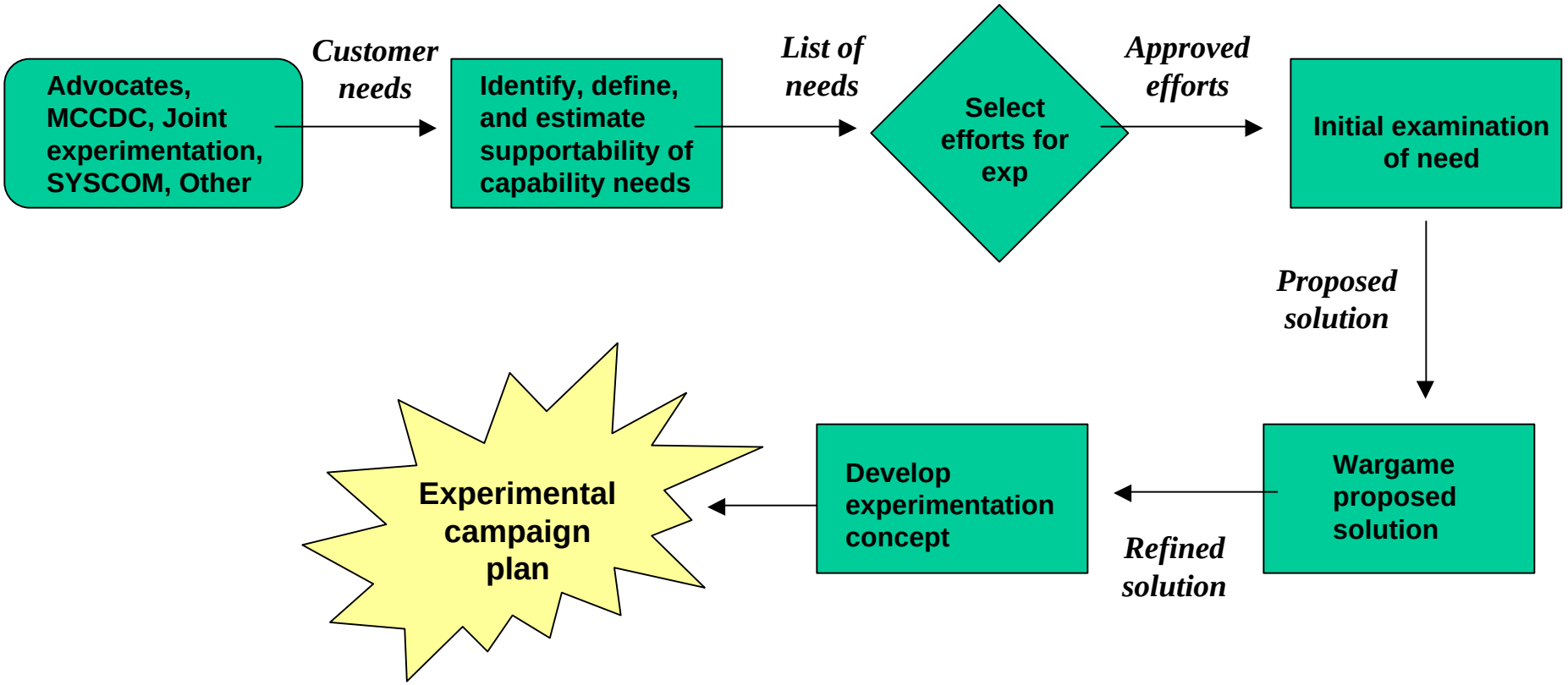


Role of other organizations

- **Advocates (CE, GCE, ACE, CSS)**
- **Operating Forces**
- **MCCDC (EFDC)**
- **Systems Command (SYSCOM)**
- **ONR and the S&T community**
- **JFCOM J-9**

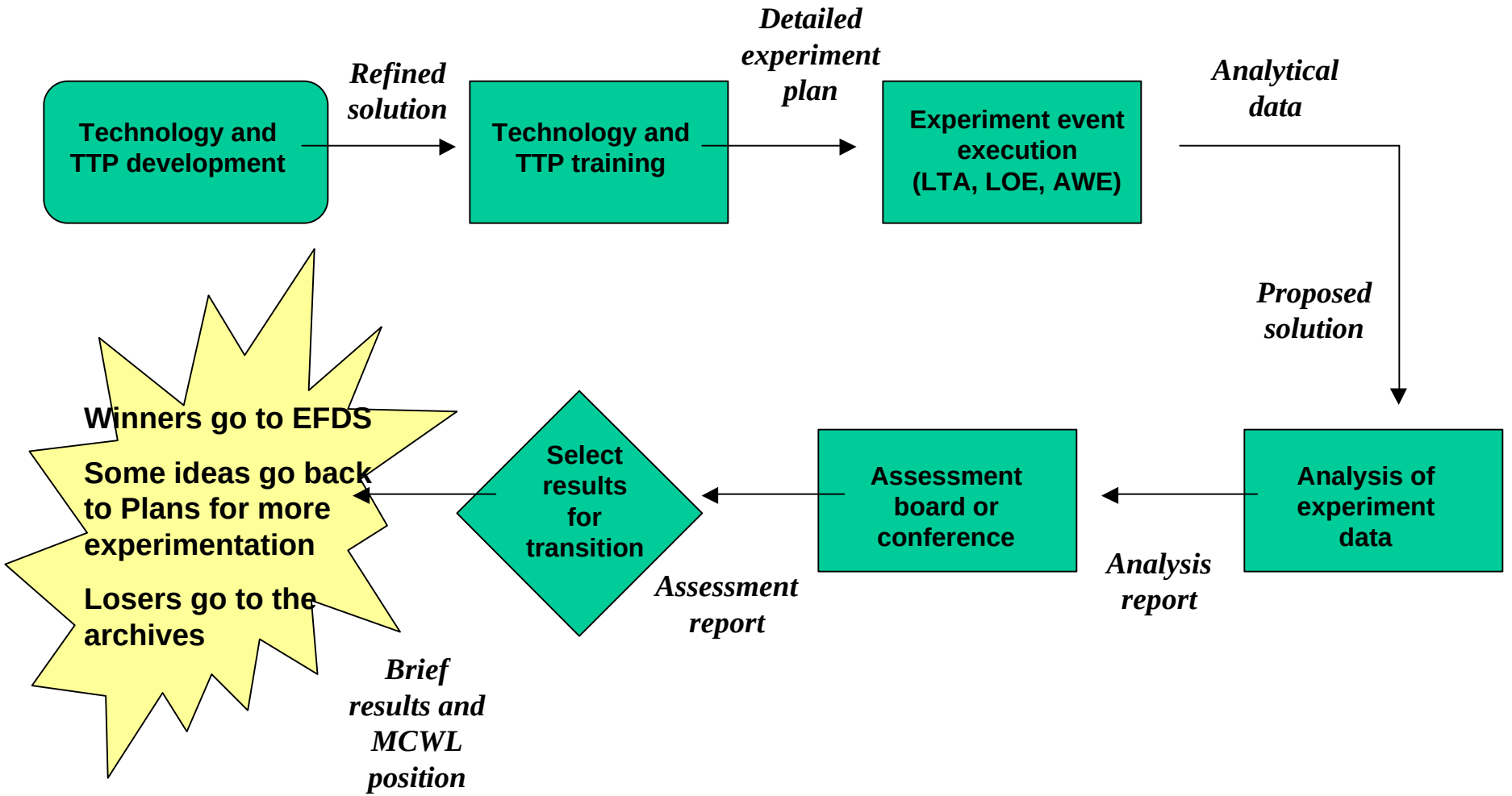
Will bring a variety of diverse agendas that you must manage

General planning and design



Ref: MCWL Experimentation Campaign Plan: 2001

From *the* plan to transition



Elements of planning and executing MCWL experiments

- **Objectives**
- Hypotheses
- Design
- Plans
- Execution
- Analyses and assessment

First step: Establish a desired objective

- **Start with a basic question**
- **Find out what's been done before**
- **Define the problem in a constructive way**
- **Scope the problem**

Establishing a desired objective

Objectives should be based on transition goals

- **What is *transition*?—it's how to turn an experimental output into a USMC capability**
- **Transition involves getting others to pay attention to our experimental results**
- **There are many different kinds of transition products**

Without a transition goal, there is no reason for doing an experiment

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Next step: Develop hypotheses

- **Facilitates experimentation process**
  - **Hypotheses helps you focus on what's important**
- **Without a hypothesis, observing a measurable change in capabilities is difficult**
  - **Helps establish a cause and effect**
- **Provide a scientific basis for experimentation**

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Develop a *campaign* design

- **Iterative process**
- **Series of tailored events that support program milestones**
- **Events may include wargames, workshops, LTAs, LOEs, AWE, Demos,**
- **ORM for experiments**

Individual experiment design

- Type of event
- Scenario
- Iterations
- Baseline
- Control

MCWL experiments

Limited Technical Assessment

- Measure performance parameters of developmental item
- May be conducted in tactical setting, but not focused on TTPs, or how unit mission is impacted

Limited Objective Experiment

- May include LTA-like objectives but focused on TTPs, and assessment of how an innovation impacts combat mission
- Limited scope and scale

Advanced Warfighting Experiment

- A culminating experiment
- Combines numerous innovations
- Large scale

Demonstration ???

Design challenges

- **Achieving realism**
- **Baselines**
- **Using surrogates**
- **LTAs as thresholds for LOEs/AWEs**
- **Confusing Demos and Experiments**

Experiment variables

<u>Constants</u> – conditions that *by design* do not vary

e.g. – force-on-force adjudication procedures

<u>Independent variables</u> – *Purposely altered* conditions

e.g. – daytime/night or the innovation itself

<u>Dependent variables</u> – the *UNCONTROLLED* and variable outcomes

e.g. – enemy KIAs

Lessons learned—design

- **Experiments with numerous innovations often have conflicting variables**
  Best experiment has only ONE innovation
  KISS rule applies!!

- **Experiment objectives shift**
  Must start over with new hypotheses

- **Required resources not available**
  Re-design or set objectives lower

- ***Pre-mature design***

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Plans should contain…

- **5-paragraph order PLUS…**
  - **Analysis Plan**
  - **Experiment Control**
  - **Training Plan for new equipment and TTPs**

Experiment plans should be published

Elements of planning and executing MCWL experiments

- Objectives
- Hypotheses
- Design
- Plans

➢ **Execution**

- Analyses and assessment

Execute

No plan ever survives the first round down range!!!

Changes often require a hasty re-work <u>starting with the objectives that can be achieved</u>

Experiment control

The MEANS by which the experiment variables are controlled.

Control “tool” box

- Scenario and scenario input
  - HHQ orders
  - HHQ response cell
  - Intell
- Live controllers
- Communications to experiment force and controllers
- Simulations and adjudication
- Computer-based simulation and adjudication
- Manual / procedural simulation and adjudication

Elements of planning and executing MCWL experiments

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➢ **Analyses and assessment**

Data collection

- ***Critical step*: Without data, there is no experiment**
- **Data collection doesn't just happen, it must be planned**

Some tips…

Focus on what's important vice everything

Get dedicated resources…can't be done well by participants themselves

Doesn't always mean an "analyst" collecting data…but for some experiments that's preferred

Analysis and reconstruction

- **Happens after experiment ends**
  - **But it's planned for before an event**
- **Involves matching the objective and hypothesis to the collected data**
  - **Purpose is to figure out what happened and what it may mean**
- **Leads to a product**

Assessment

- **Purpose is for MCWL to decide what to do with analytical results**

- **Happens after an analysis report has been written**
  - **Analysis forms the basis for the assessment,**
  - **May consider other factors (e.g., external considerations, CMC guidance, etc.)**

- ***Should* lead to a product that states MCWL's position and major takeaways from the experiment**

Key takeaways…

- **Experiments are important, but they are hard to do**
  - **Lots of things can go wrong**
  - **Various ways to avoid problems / avoid repeating mistakes**
- **Most critical phase is the beginning**
  - **Important to focus on *why* we are experimenting**
- **The only failures are when we don't write things down**
  - **If there is no data or results, there is no proof that we did an experiment**

…and other lessons

- **“Failed” experiments**
- **The “GIZMO” focus trap**
- **The “Can I play too?” trap**
- **The unwilling “Turkish Test Pilot”**
- **Concurrent training**

Professional reading list

Recommended

X-File 5-12X, Experiment Procedures – MCWL

Code of Best Practice/Experimentation – CCRP for DOD

The Practice of Military Experimentation – CNA

Military Innovation in the Inter War Period – Murray and Millett

For advanced study

Woton's Workshop: Military Experiments Before the Second World War – CNA

The Art of Military Experimentation – CNA

Methods of Operations Research – Morse and Kimball